Pest Leaflet

Pacific Forestry Centre 506 West Burnside Road Victoria, B.C.

Pine Needle Casts and Blights
In the Pacific Region

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Introduction

Discolored needles on pine trees are so prevalent that the condition is often considered natural; however, this symptom is generally the result of diseases or insects. The destruction of foliage may result from non-infectious or infectious disease agents. Non-infectious disease agents, such as early or late frosts, winter drying, drought or air pollution, are adverse elements of the environment. Infectious foliage diseases are caused by fungi. Some of the more common infectious diseases causing premature defoliation of pines in the Pacific Region are the subject of this leaflet. These include:

needle casts: *Lophodermella concolor* (Dearn.) Darker

L. montivaga Petr.

Davisomycella ampla (J.J. Davis) Darker

needle blights: *Scirrhia pini* Funk and A.K. Parker

Leptomelanconium pinicola (Berk. & Curtis) R.S. Hunt

Major additional damaging needle diseases caused by *Elytroderma deformans* (Weir) Darker and *Lophodermium seditiosum* Minter, Staley & Millar (formerly part of the *L. pinastri* complex), are discussed in separate leaflets (8, 16). Other pine needle diseases occurring in the Pacific Region are included in Table 1.

Hosts and distribution

Needle casts and blights of pines are common throughout British Columbia (B.C.) and the Yukon. The more common are native throughout the Pacific Northwest and *Scirrhia pini* has gained worldwide distribution due to the planting of contaminated exotic pines and the accidental introduction in portions of the world formerly free of the problem (6, 7).

In B.C., the distribution of some casts coincides with host distribution. *Lophodermella concolor* samples from *Pinus contorta* Dougl. are frequent over the southern half of the province, particularly from the Kootenays, and occasionally important as far north as the Yukon. *Lophodermella montivaga*, also from *P. contorta* var. *latifolia* Engelm.

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Table I. Other pine needle diseases occurring in the Pacific Region

Causal agent	Native pine hosts	Notes
Bifusella linearis (Peck) Hoehn.	western white and whitebark	Forming long black sooty fruiting bodies (imperfect state) on needles. Known to cause local damage.
Bifusella saccata (Darker) Darker	whitebark	Very rare, similar to B. *linearis* but differing in spore shape.
Lophodermella arcuata (Darker) Darker	western white and whitebark	Elliptical fruit bodies concolorous with the dead needles on which they occur. Causing considerable damage to western white pine in Idaho (12).
Lophodermium nitens Darker	western white and whitebark	Fruit bodies elliptical, shiny black and conspicuous. A weak parasite attacking old needles and fruiting after the needles are shed.
Lophodermium pinastri (Schrad.: Hook.) Chev.	all pines	Common secondary organism, often on foliage attached to cankered branches.
Meloderma desmazierii (Duby) Darker	western white	Rare. Fruit bodies black, elliptical, similar to *L. nitens* but differing in microscopic characteristics.
Naemacyclus niveus (Pers.: Fr.) Sacc.	lodgepole	Fruit bodies elongate to rectangular, light straw color when fresh. Serious needle cast on Scots pine (*P. sylvestris* L.) but not natives.

(lodgepole pine), seems to be particularly more important in the Yukon and northern areas of B.C. and occasionally in southern areas. Most *Davisomycella ampla* collections have come from southern Vancouver Island or the lower Mainland, all from shore pine (*P. contorta* var. *contorta*). *Scirrhia pini* has been found on shore, lodgepole, white (*P. monticola* Dougl.), ponderosa (*P. ponderosa* Laws.) and numerous exotic pines, north to Prince George and Hazelton. *Leptomelanconium pinicola* has caused epidemics on ponderosa pine in the East Kootenay and on lodgepole pine in the Prince Rupert area.

Life history

A needle cast typical for the Pacific Region that has caused severe damage on lodgepole pine is *Lophodermella concolor*. This virulent disease completes its life cycle in 1 year, typical of many needle casts, especially the more damaging ones (4). Spores from previously infected year-old needles are released in July during periods of high humidity and they germinate and penetrate only young developing needles. There is little external evidence of attack during the year of infection as the fungus undergoes a period of vegetative growth within the host tissue. In May or June of the following year, these infected needles turn red-brown and by July change to the color of straw, the fruiting bodies mature, and spores, which are wind-desseminated, are produced again to complete the life cycle. The dead discolored needles commence falling at about this time. Fruiting bodies first appear as shallow depressions and are concolorous with the needle surface. Needle blights attack any age of foliage and therefore are active not only in the spring, but any time there is a coincidence of high relative humidity and spores.

Fig. 1. *Davisomycella ampla*, black oval fruiting bodies on straw-colored needle segment which is bordered by a dark orange-brown band.

Fig. 2. *Elytroderma deformans*, elongated black fruiting bodies of various lengths forming ridges.

Fig. 3. *Lophodermella concolor*, fruiting bodies forming oval depressions that are concolorous with the infected parts of needles.

Therefore, needle blights are usually more serious than needle casts. Needle blighted foliage is also cast from the tree after the spores are released.

Recognition

Generally, it is not difficult to distinguish between foliage killed by non-infectious and infectious disease agents. Damage caused by adverse environmental conditions is usually quite distinctive; tips of needles, whole needles, or whole stands become uniformly discolored, often in well-defined elevation strata or exposures. Sometimes there is the associated secondary fungus, *Sclerophoma pithyophila* (Corda) Hoehn., which is particularly aggressive on frost killed tissue.

Where pathogens are involved, sometimes only portions of needles are killed, the discoloration may be blotchy and usually healthy needles are intermingled with diseased. Some trees may suffer heavy infection while adjacent ones of the same species remain free of disease. Frequently only the lower part of the trees are attacked. With needle casts, usually some green foliage remains. Eventually the diseased needles develop dark, sometimes black fruiting bodies, often submerged, and sometimes difficult to see, in the discolored needles. Fruiting bodies may cover the entire length of the needle or be almost microscopic in size.

Damage to foliage which has discolored or been killed by insect chewing or mining is easily distinguished from that caused by disease action, especially when the insects are still present. Sawflies chew needles leaving the epidermis broken. Needle miners hollow out needles leaving the epidermis intact, with obvious small, round exit holes. Identifying aphid attack is more difficult if the feeding population has left the foliage, although some evidence usually remains, such as wool, body parts, eggs and feeding punctures. Occasionally, mites may make foliage blotchy or chlorotic (13).

By referring to the following list, some of the pine needle diseases common in the Pacific Region may be separated (Table 2).

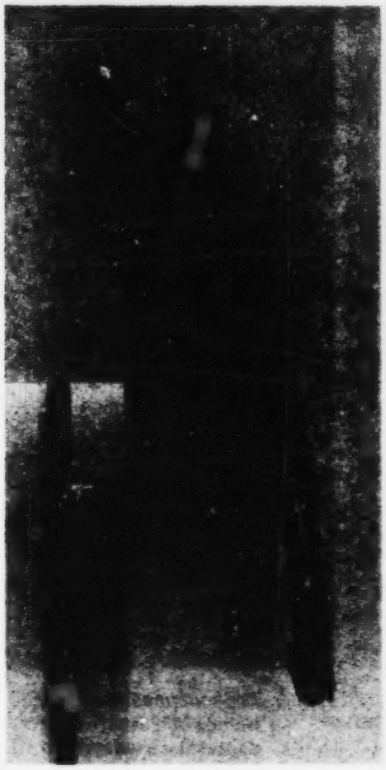

Fig. 4. *Lophodermella montivaga*, fruiting bodies with central light-colored slits.

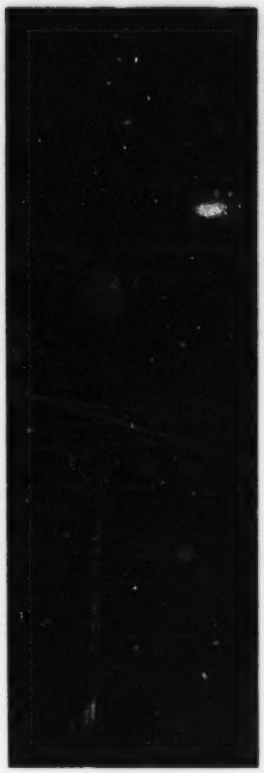

Fig. 5 *Lophodermium pinastri*, black oval pustules, which may be separated by black, transverse lines.

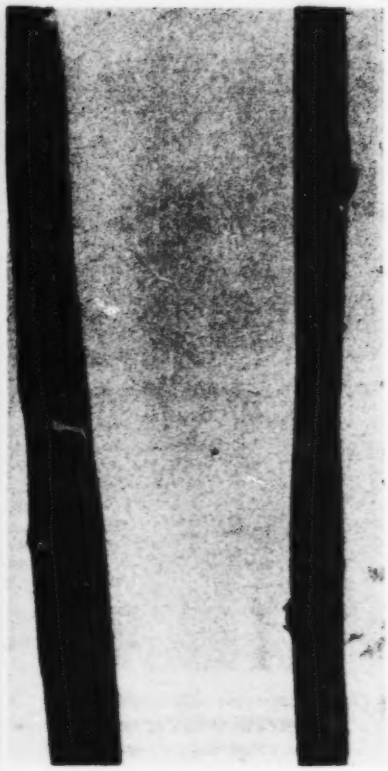

Fig. 6. *Scirrhia pini*, minute, round black fruiting bodies on red bands.

Damage

Damage caused by foliage diseases has not been investigated in detail in the Pacific Region. It is likely that increment loss is substantial when climatic conditions make it possible for these fungi to become epidemic, (9, 10) and mortality could result if these circumstances persisted, but the latter is highly unlikely, although some reproduction trees are reduced to only 1 year's foliage and sometimes killed. Conditions optimal for sporulation and infection are quite critical, very high humidity being the major requirement. In 1959, lodgepole pine throughout Kootenay National Park suffered heavy needle drop from attack by *Lophodermella concolor*, but the damage was not repeated the next year even though a massive amount of potential inoculum must have been present. Weather reports for this region show that the June-July precipitation averages, during the period which sporulation would occur, were 7.0 cm in 1959 and 2.5 cm in 1960. It is because of the critical requirements for maximum spore production, dissemination and infection, plus the fact that needles are only susceptible to infection by needle casts from bud break until maturity, that serious outbreaks over large areas occur only sporadically, except in the Kootenays where there seems to be more years with epidemics than without epidemics. Epidemics of needle blights last 1-3 years, and collapse for unknown causes. Only small and weak native trees succumb during the epidemic.

Scirrhia pini, a native pathogen, produces a toxin (1) which our native pines seem to tolerate better than exotics, e.g., when Monterey (*P. radiata* D. Don) and bishop (*P. muricata* D. Don) pines were planted in high rainfall areas of northern California (3) and Vancouver Island some were killed within 3 years (11). Young native shore pine growing in small pockets are severely defoliated and some trees are killed in coastal areas. This pathogen has a very high damage potential because of its ability to attack needles of all ages.

Table II. Distinguishing characteristics of the common needle diseases in the Pacific Region

Needle Cast	Pine hosts	Distinguishing characteristics
Davisomycella ampla (Fig. 1)	shore	Fruiting bodies are black oval pustules located on straw-colored segments of needles. These segments may be separated from green portions of needles by an orange-brown band.
Elytroderma deformans (Fig. 2)	lodgepole, ponderosa	Elongated black fruiting bodies of various lengths forming ridges on freshly killed red-brown needles, which become straw-colored when fruiting bodies are mature. It also can cause brooming.
Leptomelanconium pinicola	lodgepole, ponderosa	Similar to *S. pini*, but lacking red bands on brown or straw-colored needles.
Lophodermella concolor (Fig. 3)	lodgepole, shore	The concolorous fruiting bodies are very inconspicuous, forming small oval depressions in the early stage of development. Discoloration of needles is similar to that caused by *E. deformans*.
Lophodermella montivaga (Fig. 4)	lodgepole	Brown elongated fruiting body often showing a light-colored slit in the center, which differentiates it from *Elytroderma*.
Lophodermium pinastri (Fig. 5)	jack (*P. banksiana* Lamb.), lodgepole, ponderosa, white	Black, oval pustules scattered over the dead needle, separated by shiny black, transverse lines.
Lophodermium seditiosum	Scots, Austrian (*P. nigra* Arnold), and other exotic	Similar to *L. pinastri*, but transverse lines lacking or brownish.
Scirrhia pini (Fig. 6)	lodgepole, ponderosa, shore, white	Minute, flaps of host epidermis lift to expose spore masses usually on red bands of brown needles.

Control

Some biological control of needle diseases occurs. Many fungi develop saprophytically in needle tissue damaged or killed by the attack of more virulent primary pathogens without affecting the development of the primary fungi. Others gain entrance into previously damaged needles and compete so vigorously for food synthesized by the primary fungus that they inhibit or prevent the development of spores by the primary fungus and so constitute a natural control. Two examples of pathogens possibly exercising this type of control of needle cast fungi in B.C. are *Hendersonia pinicola* Wehm. following *Lophodermella concolor* on lodgepole pine (2, 5) and *Hemiphacidium planum* (Davis) Korf after infection by *Bifusella linearis* (Peck) Hoehn. on white pine and whitebark pine (*Pinus albicaulis* Engelm.).

Victoria herbarium (DAVFP) records show that the distribution of *Hendersonia pinicola* coincides

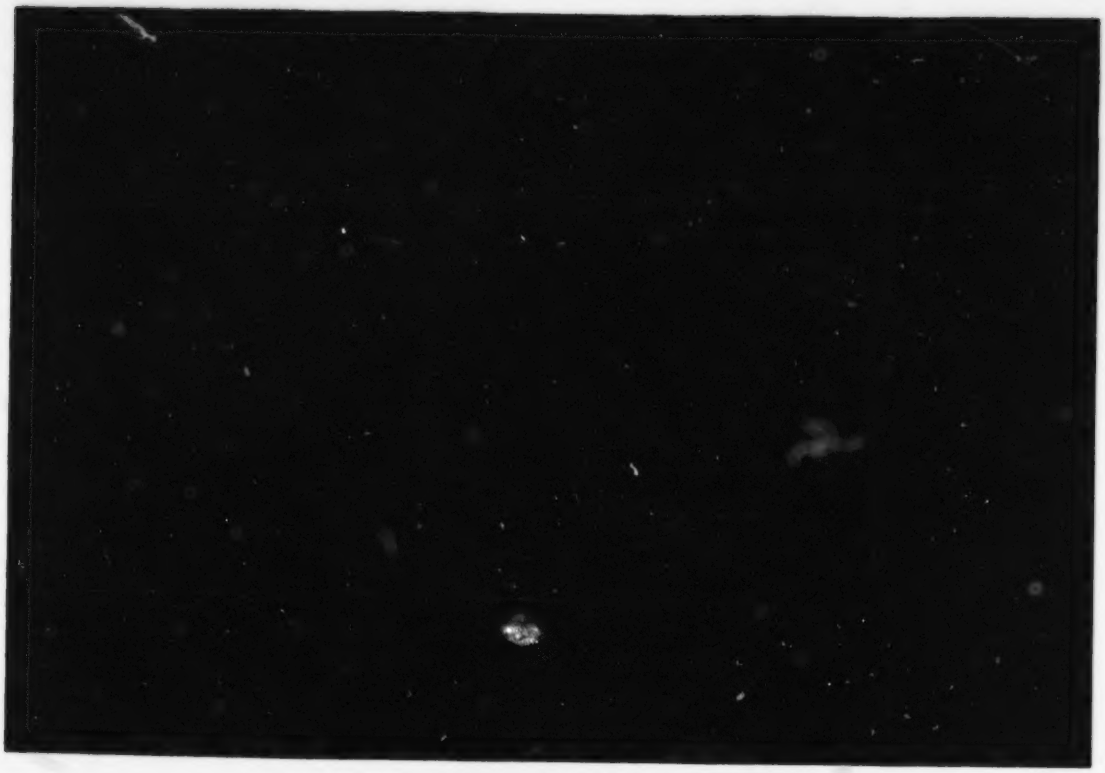

Fig. 7. Lion's tailing as a result of blighting to ponderosa pine.

Fig. 8. Needle blight defoliation of ponderosa pine.

with that of *L. concolor*. Although collections are sparse in the northern half of the Province, one record came from Mayo in the Yukon, so it may be assumed *H. pinicola* exerts some control over *L. concolor* throughout its host range. A total of 110 *P. contorta* samples showing symptoms of *L. concolor* infection were found to contain *H. pinicola* at the Victoria herbarium. *H. planum* collections to date are restricted to the southern part of B.C. and especially from the coast and eastern Kootenay.

Since increment loss to needle casts and blights may be severe under some circumstances (9, 10), some practical control may be necessary. Genetic variation in susceptibility is known with *S. pini* and *L. concolor*, making it worthwhile to select for the most resistant trees or select against the most susceptible when picking trees for seed orchards (14, 15). As with many other foliage and branch disease, the maintenance of vigorous growing stock by thinning and the encouragement of mixed stands where practical, will help prevent the growth loss now occurring. Nurseries growing pine stock should be located as far as possible from pine forests, as planting stock may disseminate inoculum into new areas, as has been done with *S. pini* (11) and *L. seditiosum* (16).

The chemical control of needle diseases may be practical under some circumstances, such as in nursery beds. Fungidical control with Bordeaux mixture, maneb and chlorothalonil have been used successfuly (2, 4, 16). Before using pesticidee, one should check that they are registered for use against the target pest. Formulation and application of fungicides is at your own risk.

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